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The influence of logistics preparedness on resilient disaster relief operations: evidence from disaster relief operations practitioners in humanitarian organizations in Tanzania

Yohana Arsen Rutaba, Noel Peter Mrope and Leonada Raphael Mwagike

University of Dodoma, College of Business and Economics, Department of Business Administration and Management, United Republic of Tanzania
Yarutaba@Gmail.com

Mzumbe University, Department of Procurement and Logistics Management, Senior Lecturer, Morogoro, United Republic of Tanzania
Noelmrope@Gmail.com, Leonada.mwagike@Mu.ac.tz

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Abstract

***Purpose**: This study investigates the influence of logistics preparedness on resilient disaster relief operations (DROs) in Tanzania, aiming to assess how preparedness strategies contribute to humanitarian operational resilience.*

***Design/Methodology/Approach:** The study is guided by stakeholder theory and resource orchestration theory. It adopts a positivist research philosophy and an explanatory research design. Data were collected through questionnaires and interviews from 192 humanitarian logistics and DRO practitioners in Tanzania. The sample size was determined using Slovin's formula and selected through stratified systematic random sampling. Data were analyzed using descriptive statistics and multiple linear Regression with the aid of SPSS version 27.*

***Findings:** The results indicate a strong and statistically significant positive influence of logistics preparedness on resilient disaster relief operations, with an R-squared value of 0.75. All six preparedness factors showed significant effects ($p < 0.05$). Key contributors include sustainable and flexible financial resource allocation ($\beta = 0.312$, $p = 0.003$), skilled personnel deployment ($\beta = 0.276$, $p = 0.002$), investment in financial risk management ($\beta = 0.256$, $p = 0.022$), capacity building ($\beta = 0.189$, $p = 0.011$), physical resource maintenance ($\beta = 0.224$, $p = 0.035$), and sustainable practices ($\beta = 0.198$, $p = 0.005$).*

***Research Limitations/Implications:** The study is geographically limited to specific regions in Tanzania. Future research should consider broader national or cross-country comparisons and longitudinal analysis.*

***Practical Implications:** Humanitarian organizations should prioritize logistics preparedness initiatives and develop structured plans that strengthen response capacity and resource readiness.*

***Social Implications:** Enhancing logistics preparedness can lead to more effective, timely, and community-sensitive disaster response systems.*

***Originality/Value:** This study adds empirical evidence and theoretical depth to humanitarian logistics by validating stakeholder and resource orchestration theories. It highlights the strategic role of preparedness in ensuring resilient disaster relief operations.*

***Keywords:** Logistics Preparedness, Disaster Relief Operation, Resilient Disaster Relief Operation, and Humanitarian Organizations.*

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1. Introduction:

1.1. Background of the Study

In the past years, it has been evident that the occurrence of disasters has greatly affected the lives of humans due to delayed responses and ineffectiveness in the process of rescue and distribution of relief supplies to the affected population (Nayak & Choudhary, 2020; Masoumi et al., 2021). The occurrence of disasters and the repercussions to human lives have necessitated researchers' and policymakers' attention to instituting measures, models, and procedures to minimize the impact of natural and manmade disasters (Negi, 2022). Considering the devastating effects of disasters, both natural and manmade, governments worldwide are instituting agencies, departments, and organizations that are responsible for ensuring proper coordination for rescue and provision of relief supplies once a disaster strikes (Wankmüller and Reiner, 2019). In the efforts to develop mechanisms to solve the aftermath of disasters, there are also polices and regulations imposed as interventions for proper disaster relief operations (Dohale et al., 2022).

Furthermore, efforts to achieve effectiveness in disaster relief operations have been a huge concern globally and have been the major challenge for government and humanitarian organizations (Dubey et al., 2020; Magalhães, 2020). It is evident that natural disasters globally pose significant challenges to supply chain management and logistics (Wendler, 2017). These challenges are linked to rescue efforts, resources, logistics integration, and distribution of relief supplies. Extensive studies have internationally highlighted these complexities and challenges faced during relief operations (Aghsami et al., 2024). In recent years, research studies have extensively analyzed response operations for major disasters in countries like India, Pakistan, and Malaysia, revealing key practices and challenges, particularly in post-disaster relief. In this regard, the major challenges include manpower shortages, insufficient equipment, lack of coordination, and communication barriers (Argollo da Costa et al., 2014; Argollo da Costa et al., 2015). Similar challenges were explained in relation to the Ludian earthquake in China by Wang (2024). The studies above posed the severity of the disasters and emphasized the Integration of the critical role of logistics in managing complexities in relief operations. Despite these insights, there remains a need for further research and exploration to enhance efficiency in humanitarian logistics associated with relief operations. The current studies have not adequately linked humanitarian logistics practices to the resiliency of disaster relief operations.

Further to scholars' and research contributions, relief efforts coordination and severity of disasters on lives have garnered attention from several humanitarian organizations, NGOs, international humanitarian organizations, and governments (Altay et al., 2018; Dubey et al., 2019). Disasters are explained to challenge the ability of nations to protect people's lives (Altay & Green, 2006). As reported by the Centre for Research on the Epidemiology of Disasters (CRED), in 2019 alone, around 395 natural disasters resulted in approximately 11,756 deaths, affected 95 million people, and incurred costs of nearly $130 billion (CRED, 2020). A similar trend was observed in 2018 with 281 events causing 10,733 fatalities (Dubey et al., 2019b). The statistics show that the frequency of disaster occurrence has increased from 220 annually in the mid-1990s to around 360-420 per year currently.

Recent research studies in Africa highlight the challenges and possible strategies for effective disaster relief operations. The studies narrated the key barriers, which include lack of planning and preparedness, logistics, coordination, and public perception (Baidoo, 2018; Maghsoudi & Moshtari, 2020). In efforts to address the issues, researchers provided suggestions that are related to improving training, stakeholder coordination, and increased funding of disaster relief operations (Okdinawati et al., 2019; Baidoo, 2018). However, despite these numerous contributions, effectiveness in coordination remains a significant challenge (Gupta et al., 2016). In Ghana, researchers narrated a problem in disaster relief operations to be slow response time, resource availability and coordination of resources, management of relief supplies, and coordination among relief actors (Owusu-Kwateng et al., 2017). In Zimbabwe, Mbohwa (2010) narrated logistics challenges in disaster relief operations, including poor hospital service quality, inadequate infrastructure, and funding issues.

Furthermore, in the context of East African nations, humanitarian logistics in relation to disaster relief operations are not immune to the narrated logistical and resource challenges. Natural and manmade disasters have been shown to cause huge effects on the population due to these challenges, as disasters also cause disruption in the supply chain, which necessitates robust business continuity plans (Kangogo et al., 2013). A well-structured and planned humanitarian logistics can play a crucial role in emergency responses, as shown by Kimori Osumo & Omwenga (2024). In Uganda, Korir et al. (2023) emphasize the importance of transport, order processing, information flow, and inventory management for effective disaster response. However, challenges like inadequate finances, inefficiencies

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in relief supplies distribution, and poor coordination persist (Orach et al., 2013). There are disasters that have impacted populations in Kenya, Rwanda, Uganda, and Congo. The literature contribution from these nations intensifies the common challenges in relief operations, like poor coordination of relief operations, resource and capacity to respond to disasters rooted in preparedness and effective distribution of relief supplies and coordination of relief efforts (Bahal'Okwibale 2018; Shears & Garavan 2020; Sospeter 2023; Komorowski & Karume 2015; Agrawal 2013). Research also noted the inefficiencies in information distribution and the lack of specialized information systems specific to disaster operations coordination (Kumar & Luthra, 2020; Kumar & Lakshmi, 2015; Tarei et al., 2024).

In the Tanzanian context, in recent years, disasters have had severe impacts, with floods from 2015 to 2020 resulting in 307 deaths, affecting 317,907 individuals, and destroying 50,588 houses. Regions like Mwanza, Morogoro, and Dar es Salaam have been significantly affected. For example, the 2015 rainstorm in Kahama resulted in 47 deaths, affecting 3,500 people and destroying 634 houses (PMO, UNDRR, 2022). Tanzania has also experienced notable maritime disasters, such as the MV Nyerere ferry tragedy in 2018 and the MV Spice Islander disaster in 2011 (PMO, UNDRR, and CIMA, 2019). As this current study intended to examine the effect of humanitarian logistics preparedness on resilient disaster relief operations, in this examination, the study applied resource stakeholders' theory and orchestration theory. Previous studies provide a path into the application of these theories in humanitarian logistics and disaster relief operations. For example, Jusoh et al. (2024), in their study about humanitarian operations performance through logistics preparedness, focused on resource-based theory and stakeholders' theory in the context of humanitarian logistics in Malaysia. Ruiter & de Vries (2024), in their paper about the efficacy of humanitarian aid, suggested that effective resource orchestration and stakeholder engagement can enhance operational efficacy, which is also suggested by Tosi & Marty (2024). Mutebi et al. (2023), in their paper about stakeholder expectations, inter-organizational coordination, and procurement practices among humanitarian organizations, primarily focus on Stakeholder Theory, emphasizing the interconnectedness of stakeholder expectations, inter-organizational coordination, and procurement practices in humanitarian organizations, particularly in Uganda, which is also discussed in the research work by Nawazish et al. (2023). On the other hand, Fu et al. (2022) emphasize leveraging stakeholder resources to enhance disaster resilience, aligning it with resource-based theory and stakeholder theory.

1.2. Statement of the Problem

Disaster relief operations need proper handling when associated with alleviating the suffering of affected people. Mendy et al. (2023) stated that properly handled humanitarian logistics and disaster relief operations can enhance the efficiency and effectiveness of aid delivery, and this can help to ensure timely assistance to affected populations. Furthermore, Osumo & Omwenga (2024) in their study in Kenya pointed out that proper humanitarian logistics can enhance disaster relief operations by ensuring efficient resource allocation, improving response times, and fostering strategic alliances. Ito et al., (2014) highlighted that poor logistics operations can lead to severe issues, termed "the second disaster," and this is due to inadequate disaster preparedness and a lack of understanding among involved sectors, ultimately hindering effective relief efforts and response efficient, furthermore Shaqiri (2018) and Zain et al., (2021) propounded that these factors in totality hinder timely and efficient disaster relief operations, ultimately impacting human life and property during emergencies. This highlights the need for better emergency planning to mitigate risks and disruptions.

Furthermore, protection of human lives and alleviating the suffering of the people in a disastrous situation has been a primary concern for different governments and established humanitarian organizations and agencies (Bizzarri, 2012; Holthus et al., 2020; Ayiek & Deng, 2024). Efforts are undertaken to ensure proper coordination in humanitarian efforts. In Tanzania, several efforts have been undertaken to mitigate the impact of disasters, from creating public awareness campaigns fostering community engagement in rescue operations to the establishment of international relief organizations and non-governmental organizations (NGOs) (Majamba, 2023; Msemo et al., 2021; Rutaba, 2023; Rutaba, 2022). The Government of Tanzania has also established the Disaster Management Division under the Prime Minister's Office (PMO) for disaster relief coordination. The Government has also enacted policies and Acts to support Disaster Risk Management (DRM) across various sectors, addressing issues like environment and climate change, public health, food security, and military support in public emergencies (Mboera et al., 2012; Daly et al., 2015; Majamba, 2023; Msemo et al., 2021). Despite these efforts, the frequency and severity of disasters continue to rise, revealing persistent gaps and inefficiencies in disaster relief operations: from coordination of activities, data sharing, rescues, and relief supplies storage and distribution (Sama, 2023; Majamba, 2023; Zain et al., 2023; Salam & Khan, 2020; Sahay et al., 2016). These

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inefficiencies in disaster relief operations have led to an increase and intensified suffering of the disaster-affected people (PMO, UNDRR, 2022; CIMA, 2019; Sama, 2023; Majamba, 2023).

Furthermore, despite the pressing need for improved disaster operations management, there has been limited empirical evidence and contributions to humanitarian logistics and disaster relief operations in Tanzania. Existing studies, such as those by Masoud (2022) and Rutaba (2022, 2023), have explored various aspects of humanitarian logistics performance, challenges in disaster management, and logistics cooperation in effective disaster relief operations. In addition to that, Koka et al. (2018) examined disaster preparedness and the response capacity of regional hospitals, while Mbura (2014) focused on disaster management and persistent flooding. However, these studies have not adequately articulated the critical aspects of logistics factors for adaptive and rapid disaster relief operations; the studies clearly noted that poor disaster relief operations are amplified by poor logistical coordination.

Therefore, this current study will focus on examining the Contribution of humanitarian logistics preparedness to resilient disaster relief operations. The outcomes of this research are expected to contribute to the development of comprehensive humanitarian logistics contingency plans, which are crucial for ensuring effective disaster relief operations in Tanzania (Rutaba, 2023; Rutaba, 2022; Kovács & Spens, 2007; Apte, 2010).

2. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Stakeholder Theory

R. Edward Freeman is widely recognized as the founder of this theory, who has fully articulated the framework in his 1984 book “Strategic Management: A Stakeholder Approach” (Paas, 1996; Kivits & Sawang, 2021). Freeman defined a stakeholder as “any group or individual who can affect or is affected by the achievement of the organization’s objectives” (Kivits & Sawang, 2021). The theory has since gained significant traction in corporate, governmental, and academic spheres (Kivits & Sawang, 2021).

In practical premises and applicable narrations, this theory illustrates that the occurrence of disaster affects all the stakeholders and their activities, and generally they affect the whole business of organizations’ operations and disrupt the normal operations of supplies and supply chains (Gunasekaran et al., 2018; Freeman, 2010). In order to deal with the disruption and maintain order in the systems, the stakeholders need to be well prepared and to effectively coordinate their resources and strive to maintain the resilience of the systems and ensure continuity of operations in the normal way by absorbing the shocks (Carter, 2015; Pfeffer and Salancik, 1978, 2003).

Ademola (2014) demonstrated that the effectiveness of disaster operations done by humanitarian organizations is definitely determined by the preparedness of the stakeholders with vested interests in disaster relief operations (Godam, 2019; Shan-Bing, 2008; Parboteeah, 2018). Stakeholder Theory underscores the importance of engaging all relevant parties—local authorities, relief organizations, and community groups—in disaster preparedness. By aligning the interests of these stakeholders, the theory ensures that logistics preparedness benefits everyone involved and fosters effective coordination. This approach, which emphasizes value creation and stakeholder relationships, enhances resilience and ensures a timely and efficient disaster response (Freeman et al., 2004; Sachs & Rühli, 2011; Mitchell et al., 1997).

2.1.2 Resource Orchestration (RO) Theory

Coupling to the grounding of stakeholder’s theory, as the theory depicts the relationship between stakeholders, is essential to also include their existence with the supporting resources in relief operations, which takes us to the complementarity of resource pooling reflecting from orchestration theory (RO). RO, according to Sirmon et al. (2007, 2011), is presented as a rich theoretical foundation combining the resource-based view theory and dynamic capability view theory into one theoretical framework for the purpose of overcoming the constraints addressed by each. Both theoretical views contend that possessing resources and capabilities is hard and difficult to duplicate, that they are valuable, rare, non-substitutable, and inimitable. However, on these theories, despite the identification of criteria that resources and capabilities must suffice to be viewed as the source of sustained competitive advantage, later were criticized because none explain how strategically organizations can leverage their resources and capabilities to gain the value creation outcomes (Malik et al., 2021; Gligor et al., 2022).

In this study, in essence, Resource Orchestration (RO) theory is highly relevant to understanding how logistics preparedness contributes to resilient disaster relief operations, hence complementing stakeholder

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theory to include resource pooling as one of the critical aspects powering preparedness. The theory provides a framework for strategically managing and mobilizing resources like supplies, Personnel, and infrastructure under challenging disaster conditions. RO emphasizes not only possessing valuable resources but also effectively deploying them through structuring, bundling, and leveraging.

2.2 Empirical Literature Review: Logistics preparedness and disaster relief operations:

Humanitarian logistics (HL) plays a critical role in disaster relief operations, facing numerous challenges that require effective management. Recent studies have highlighted the increasing frequency of natural disasters and the need for improved HL practices (Negi, 2022; Negi & Negi, 2020). Key issues include coordination among stakeholders, resource allocation, and supply chain efficiency (Shafiq & Soratana, 2019). To address these challenges, researchers have proposed frameworks focusing on preparedness and response stages, emphasizing the importance of standardization and lean management principles (Negi & Negi, 2020; Shafiq & Soratana, 2019). The Multiple Aggregation Prediction Algorithm (MAPA) model has been suggested to manage challenges and address specific relief needs (Sreedharan et al., 2020). While most studies employ qualitative approaches, there is a need for more quantitative research and practical implementation of proposed frameworks (Shafiq & Soratana, 2019; Sreedharan et al., 2020). Improving HL operations can significantly reduce the impact of disasters on affected populations (Negi, 2022).

Negi (2022) conducted a study on a humanitarian organization's perspective on humanitarian logistics challenges in disaster relief operations. The study aimed to illustrate the challenges and issues impeding HL in relief operations. In this regard, the key objective of this specific study was to emphasize how HL is critical in disaster management and the identification of the issues affecting humanitarian organizations (HO) in managing logistics during disasters. A qualitative approach was employed in the study to investigate the problems affecting HL and supply chains, using a literature analysis on disaster management. The results managed to identify several challenges, which reinforced why it is necessary to carry out additional research in HL operations, including resource mobilization and logistics planning challenges, collaboration challenges, and illustrated the limitations of the literature on these aspects. The study concluded that, as natural disasters occur often throughout the world, it is essential and critical to properly and efficiently handle logistics when a disaster strikes. It should be noted that not all disasters can be prevented, but the impacts can be minimized by adequate efforts and mechanisms for preparedness and humanitarian logistical operations.

The efficiency of humanitarian assistance post-disaster relies heavily on the capabilities of logisticians to procure, transport, and deliver necessary provisions swiftly (Sahay et al., 2016). Unlike conventional logistics, humanitarian logistics focuses on delivering aid such as food, water, medical support, and shelter (Kovacs & Spens, 2009; Tatham, Spens & Kovacs, 2017). These operations often face logistical complexities, issues in HL management, disaster management policies, and financial constraints (Thevenaz & Resodihardjo, 2010). Kwateng, Hamid, and Debrah (2017) conducted research in Ghana focusing on disaster relief logistics, particularly examining emergency relief coordination and inventory management effectiveness. Their study revealed delays in relief item delivery, challenges in resource availability, and inefficiencies in inventory management and coordination among relief actors, which stemmed from a lack of proper planning and preparedness.

Reflecting on the 2017 Kermanshah earthquake, Maghsoudi and Moshtari (2020) conducted a study on challenges in disaster relief operations, and the study managed to identify the constraints during the recent disaster relief operations in a developing country, where the humanitarian response is quite dominated by the national domestic actors, with a minor role of international involvement. The study used a case study research design here, and the main data sources were semi-structured interviews with 43 key participants involved in the disaster relief operations. The findings of the study suggest that humanitarian practitioners deal with a number of constraints during disaster relief operations. One side of the challenges is associated with humanitarian logistics (stressing needs assessment, supplies procurement, storage, transportation, and distribution), all of which are largely discussed in the literature. On the other side, it involved the growing concern about the usage of legitimacy regulations, engagement of new humanitarian stakeholders (like social media activists and celebrities), and the usage of social media. The study added that practices relating to these factors have not been extensively studied in the present literature; given their growing influence, more scholarly attention is demanded.

In other aspects, in one of the reputable journals of Humanitarian Logistics and Supply Chain Management, the Journal of Humanitarian Logistics and Supply Chain Management (JHLSCM), from global response to local

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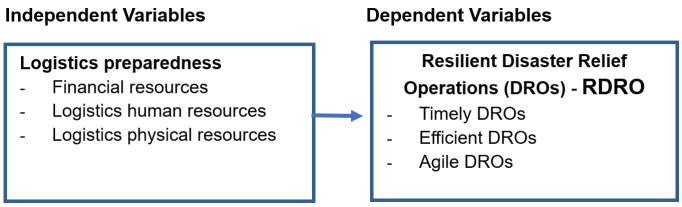
preparedness, Jahre and Jensen (2021) conducted a study on coordination at the 10-year mark of the JHLSCM on empirical contributions on logistics preparedness in relief operations. The authors of the study narrated that there is little empirical Contribution to the study of logistics preparedness in relief operations. Their focus was on the inception of the Journal of Humanitarian Logistics and Supply Chain Management (JHLSCM), logistics coordination, and preparedness, which were identified as important, both in practice and research, but few studies on the topic had been published.

2.3 Conceptual Framework

This poses a conceptual framework on the relationship between the independent variables and dependent variables. Independent variable being humanitarian logistics preparedness, and dependent variable being resilient disaster relief operations (facilitate affected ones in a timely, agile, and effective manner)

Figure 1: Conceptual Framework



Source: Researcher's own Construction (2024)

2.6 Hypothesis development

Humanitarian logistics preparedness is crucial for effective disaster relief operations (DROs), but lacks a unified understanding across organizations and research (Jahre et al., 2016; Negi & Negi, 2020). Humanitarian logistics preparedness may be postulated in preparedness in logistics, financial resources, logistics human resources, and logistics physical resources (Jahre et al., 2016). Effective DROs require proper planning, coordination among actors, and adaptation to specific disaster phases (Kovács & Spens, 2007). Researchers suggest that further studies in operations management and research could improve the efficiency of humanitarian logistics, despite its inherently chaotic and complex nature (Apte, 2010). Developing a common understanding and framework for logistics preparedness can enhance visibility and knowledge in this critical field (Jahre *et al.,* 2016). Hence, the study intends to test the relationship between Humanitarian logistics preparedness and resilient disaster relief operations through testing the following hypothesis (H_1)

H_1: Logistics preparedness has a significant impact on resilient disaster relief operations in Tanzania

3. METHODOLOGY

The study adopted a positivist philosophy, which is useful in this study because of its main characteristics. The study collected data from a large sample size instead of focusing on the details of the research. According to Saunders et al. (2016), focusing on this philosophical undertaking, positivist philosophy helps in the examination of the association between two or more variables. In terms of design, the study adopted an explanatory research design, using a mixed research approach to include quantitative and qualitative data and provide a combined explanation. The study collected both forms of data during the study and then integrated the information to interpret the overall results. Explanatory research design is relevant when researchers aim to explain the relationships between variables (Creswell, 2012).

This study was conducted in Tanzania with the experience of humanitarian logistics and disaster relief practitioners working in humanitarian organizations located in Tanzania. The data were collected from humanitarian practitioners from these Humanitarian Organizations (HOs) located in Tanzania, utilizing the Google Search engine, and as shown in the UNHCR's Humanitarian Situation Report of 2022, most of the Humanitarian Organizations are located in the regions of Dar es Salaam, Dodoma, and Kigoma. The preliminary analysis of the population of humanitarian practitioners makes a population of 369. In this study, the target population comprises humanitarian practitioners from various humanitarian organizations and stakeholders actively engaged in humanitarian logistics and disaster relief operations. The practitioners from HOs present the units of analysis and unit of enquiry of the study. These practitioners from diverse HOs played a vital role in this study as a unit of enquiry by offering their valuable insights and opinions from professional perspectives on the management of HOs and humanitarian supply chain management. Their extensive experience in disaster relief operations positions them as key contributors, ensuring the study's comprehensiveness and relevance to real-world practices.

The study selected a sample of 192 respondents to participate in the study, which was calculated using Slovin's formula. The strength of this formula is that it enables sampling the population with a degree of accuracy, i.e., confidence levels in the statistical test

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and margins of error (Creswell, 2014; Magigi, 2015). In this respect, the study uses 5 % margin of error or confidence level. This sample comprised procurement and logistics specialists, supply chain managers, supply chain specialists, warehouse officers, rescuers, and health logistics practitioners from the humanitarian organizations. These practitioners make up the unit of enquiry for the study. This study included a mapping of sixteen (16) HOs, which were treated as strata, and to ensure effective representation of all practitioners for all the identified HOs in the regions, the sample size of 192 practitioners was proportionally allocated for each stratum. Hence, practitioners of each HOs of the sampling frame were chosen at the proportion of 0.520 (192/ 369).

Using probabilistic sampling techniques, the proportional stratification sampling approach was adopted to ensure adequate representation of the practitioners from identified HOs. According to Creswell (2012), the stratification sampling approach is used when the characteristics of a sample do not balance the population, considering several homogenous groups as supported by John, Mwakalobo, and Bengesi (2019). Practitioners in each stratum (HOs) of the sampling frame were selected at a proportion of 0.520 (192/369). In order to ensure fairness in the selection within the organization, systematic random sampling was used, selecting every second (2nd) practitioner in the preparedness list of practitioners, with corresponding phone numbers and email addresses (where the questionnaire was shared online). As for non-probabilistic sampling procedures, the researcher used purposive sampling to choose the heads of HOs (key informers). The study employed a variety of data collection tools, which enabled the researcher to collect adequate quantitative data and later triangulate the information. The tools included the questionnaires and interviews. The study involved a data collection process through the distribution of copies of the questionnaire to all the respondents, observing the setting of the departments, and an interview schedule was conducted with all respondents identified as heads of units or organizations.

The analysis of data in this study involved both quantitative and qualitative methods. Frequencies and percentages tables were used to analyze and interpret the numerical data. The analysis was guided by the research objective, and the data were coded, edited, and cleaned before being presented in a general table to facilitate further exploration. Descriptive statistics were used to analyze the demographic information of respondents for the qualitative data. The quantitative data were analyzed using linear regression analysis. Linear regression analysis is a statistical method that is used to estimate the relationship between one or more independent variables and a single dependent variable (Dupont, 2009). In this present study, Multiple Linear Regression was used to determine significant factors from potential explanatory variables.

Furthermore, thematic analysis was used to address the qualitative information from the key informants. The thematic analysis is aimed at complementing some of the weaknesses of the quantitative approach (Magigi, 2015). With this, Patton (2002) suggests that quantitative analysis may be too mechanical and unable to extract the feelings, emotions, and subjective responses evidenced in social science. In this analysis, the researcher followed the procedure recommended by Saunders et al. (2016), namely, familiarizing with the collected data, applying the codes to the data, searching for themes, and then identifying the relationships, polishing themes, and testing prepositions. Table 2 below provides an illustration of the variables opted for study and their definitions and variable measurements.

In testing the validity and reliability of the research instruments, they did a meticulous assessment to ensure the rigor, accuracy, and trustworthiness of the data collected. In establishing validity, the study employed multiple strategies. This was done to achieve content validity and construct validity. In this context, content validity was achieved through the Construction of questionnaire items based on well-established literature, including, for example, Jusoh et al. (2024) and Hussain et al. (2022), and to confirm the adequacy of items in measuring the constructs of logistics preparedness and resilient disaster relief operations, further validation was done through expert reviews. Also, a pilot test was conducted among a subset of humanitarian practitioners, which further enabled refinement of ambiguous or redundant items and enhanced the overall clarity and relevance of the instrument.

On the other side, construct validity was reinforced through the critical operationalization of study variables, which ensured alignment between the research objective, hypothesis, and measurement indicators. Further, the application of mixed-methods data collection—incorporating both structured questionnaires and semi-structured interview guides—enabled methodological triangulation, which by far enhanced internal validity by corroborating findings across quantitative and qualitative data sources.

Furthermore, to assess reliability, both test-retest and split-half techniques were employed. The test-retest approach here involved re-administering the same

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instrument to other respondents at different time intervals to evaluate consistency over time, and the split-half method here examined the internal agreement between divided halves of the instrument. In addition to this, Cronbach's Alpha was calculated for each scale, with values calculated that exceeded the acceptable threshold of 0.70, which indicates high internal consistency and reliability of the measurement tools.

Table 2: Assessment of Variable Measurements

Variable	Definition	Measurement	Instrument
Logistics Preparedness	- logistics financial resources - logistics human resources - logistics physical resources (Jusoh et al., 2024), From these six (6) observable statements, a construct was developed by the researcher	5-point Likert scale	Questionnaire and interview guide
Resilient Disaster Relief Operations (RDRO)	- Timely Disaster relief operations - Efficient Disaster Relief Operations - Agile Disaster Relief Operations (Hussain et al.,2022)	5-point Likert scale	Questionnaire and interview guide

Source: Researcher's own Construction (2024).

3.8 Ethical consideration

It is mandatory to adhere to ethical issues when conducting research. Therefore, the procedure for data collection under this study began when research clearance from Mzumbe University was made available to the researcher. All the procedures, including the request for an introduction letter and permission to conduct research, were adhered to prior to the data collection procedure. The research study also observes the ethical principle of beneficence as the study aims to benefit others while promoting their welfare and safety.

Additionally, the consent forms were provided to respondents, which explained the main intention of the research and the usefulness of their participation in the success of the exercise. Also, freedom to withdraw from the study at any time if they wish to do so was stipulated in the consent form to ensure voluntary participation. The ways in which anonymity would be ensured were also clarified to the respondents to ensure the confidentiality of the information provided. The originality of the document was assured through a plagiarism check.

4. FINDINGS AND DISCUSSION

4.2.2 Demographics of the respondent

The demography of the respondents is mainly based on the variables that were intended to describe the characteristics of respondents in terms of humanitarian organization region, humanitarian organization category, location, age group, experience, and specialization in disaster relief operations. According to Saunders et al. (2016), these data are used to explain how opinions and behaviors differ, and to check the extent to which the data represent the total population. The summary of the respondent's demographics is presented in Table 3. The respondents who filled out the questionnaire were the practitioners from humanitarian organizations located in Dodoma, Kigoma, and Dar es Salaam. Both technical and support staff were involved. Concerning this, some of the respondents had a relief procurement background, humanitarian supply chain background, relief operations background, and disaster management background. Moreover, after receiving the response from each practitioner, the researcher computed the average scores. Since the scale of the questionnaire ranged from 1 to 5, the average scores were rounded to one decimal place. Besides, the demographic data were also averaged based on their scales and rounded to zero decimal places.

The demography of the respondents shows that most of them (39.6 %) come from the HOs located in Dar es Salaam Region, followed by Dodoma Region (32.3 %), and Kigoma Region (28.1 %). Dar es Salaam Region is leading in terms of respondents because 39.6% of practitioners in HOs of the sampling frame are located in this Region. Kigoma Region is the last leading because only 28.1% of practitioners in HOs of the sampling frame are located in the Region. The study found that most of the HOs in Kigoma have a head office located in Dar es Salaam.

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Besides, the distribution of actual respondents based on the practitioners' HOs categories shows that the Non-Government (Local) category is leading by 41.1% followed by Non-Government (International) (35.9%), and Government (22.9%).

Furthermore, the respondents' age was distributed across all categories, with 9.9%, 53.1%, 29.2%, 7.8% and 0 % in the ranges of 18 to 27, 28 to 37, 38 to 47, 18 to 27, and above 57 years, respectively. This shows that the respondents were of different ages, with a minimum range between 18 and 27, and a maximum of over 57 years. Besides, the majority of respondents were between 28 and 37 years old and 38 and 47 years old. These results suggest that most of the respondents were middle-aged and elderly. According to Kiage (2013), middle-aged and elderly employees have adequate experience to provide the required information. Hence, the present study involved participants of all age ranges, which are representative of the total population.

The linkage with working experience in the environment is essential as it aids in accessing the right knowledge from the participants (Goel, 2016), and one way of enhancing knowledge is through the time spent performing certain activities. Based on this view, the study assessed the level of respondents' experience in disaster relief operations working with HOs. The experience was assessed in terms of the number of years the respondent has spent in disaster relief operations and humanitarian logistics. Findings on experience in disaster relief operations and humanitarian logistics revealed that 24.0% of respondents had experience of more than 10 years, 46.4% of respondents had experience between 5 and 10 years, 28.1% of respondents had experience between 3 and 5 years, and 1.6% of respondents had experience below 3 years. Having 5 years or more of experience indicates that the respondents had been involved in disaster relief operations and humanitarian logistics. Thus, this confirmed that the respondents of this study have adequate experience with the problem investigated by the current study. This finding was also observed by Tan and Wong (2015), who indicate the relationship between experience and organizational performance.

Table 3: Demographic Characteristics of Respondents (N = 192)

Variable	Category	Frequency	Percent	Valid Percent	Cumulative Percent
Age Group	18 – 27 Years	19	9.9%	9.9%	9.9%
	28 – 37 Years	102	53.1%	53.1%	63.0%
	38 – 47 Years	56	29.2%	29.2%	92.2%
	48 – 57 Years	15	7.8%	7.8%	100.0%
	Total	**192**	**100.0%**	**100.0%**	
Work Experience	0 – 3 Years	3	1.6%	1.6%	1.6%
	3 – 5 Years	54	28.1%	28.1%	29.7%
	5 – 10 Years	89	46.4%	46.4%	76.0%
	More than 10 Years	46	24.0%	24.0%	100.0%
	Total	**192**	**100.0%**	**100.0%**	
Type of Organization	Government	44	22.9%	22.9%	22.9%
	Non-Government (Local)	79	41.1%	41.1%	64.1%
	Non-Government (International)	69	35.9%	35.9%	100.0%
	Total	**192**	**100.0%**	**100.0%**	
Organization Location	Dodoma	62	32.3%	32.3%	32.3%
	Dar es Salaam	76	39.6%	39.6%	71.9%
	Kigoma	54	28.1%	28.1%	100.0%
	Total	**192**	**100.0%**	**100.0%**	

Practitioner Specialization	Rescuer	16	8.3%	8.3%	8.3%
	Supply Chain	40	20.8%	20.8%	29.2%
	Logistics Officer	24	12.5%	12.5%	41.7%
	Relief Officer	31	16.1%	16.1%	57.8%
	Relief Operations Coordinator	30	15.6%	15.6%	73.4%
	Medical Supply Specialist	18	9.4%	9.4%	82.8%
	Distribution Officer	33	17.2%	17.2%	100.0%
	Total	**192**	**100.0%**	**100.0%**	

Source: Data from Survey (2024)

4.2.3 Examination of data entry, missing data, and outliers

The initial data analysis was conducted to identify errors in the data set in the form of data entry, missing data, and outliers. This is because errors in the data set may compromise subsequent analysis and results. To ensure the data were entered correctly, a double-check approach was performed. The first check was done by verifying all entries on a case-by-case basis. The second check was conducted and verified using descriptive statistics, including mean, standard deviation, and frequency distribution. Missing data are the values of one or more variables that were not obtained for analysis (Hair et al., 2010). Missing data can lead to insignificant results because of the influence they have on data analysis. Hence, it is very important to check the patterns and relationships for missing data and properly handle them. There are three basic techniques for dealing with missing data. These are listwise deletion, pairwise deletion, and mean substitution (Kline, 2011; Schinka et al., 2003). In this study, no missing values were detected. Outliers are cases where the scores are very different from those of others in the dataset (Kline, 2011). In this study, there were no missing values, and there were no cases of outliers.

4.2.4 Descriptive statistics: mean. Standard deviation, skewness, and kurtosis

Skewness appears in three forms (left: skew < 0, normal: skew ~ 0, and right: skew > 0). Kline (2011) narrated that the value between -1 and 1 is an acceptable range for normality. However, normality is not only tested by skewness alone but also by kurtosis. Kurtosis is defined as a measure of whether the data are flat relative to a normal distribution. Some studies can decide to accept kurtosis and skewness values between -2 and +2 (Kline, 2011), and some accept -3 and +3 for kurtosis (Balanda & MacGillivray, 1988).

The descriptive statistics indicate a generally favorable perception among respondents, with mean values ranging from 3.89 to 4.35 on a five-point Likert scale. The highest-rated aspect is LOP1 (Mean = 4.35), reflecting strong logistics preparedness, while LOP6 (Mean = 3.89) is the lowest but still suggests a positive evaluation. Standard deviations range from 0.79 to 0.98, indicating moderate agreement among respondents, and variance values (0.624 to 0.960) further confirm that responses are relatively consistent without significant dispersion.

The negative skewness values (-1.12 to -0.85) indicate that most ratings lean towards higher scores (4 and 5), suggesting optimism in logistics preparedness. Additionally, kurtosis values (1.02 to 1.65) show that responses are somewhat concentrated around the mean, with LOP1 (1.65) being the most strongly agreed upon aspect. Overall, these results suggest that logistics preparedness is perceived positively, with minor variations across the different components. The consistency in responses and the tendency toward higher ratings highlight a well-established logistics preparedness framework, with opportunities for further strengthening, particularly in LOP6. Therefore, according to Kline (2011), since the values for each measure were between the required range, this shows that the variable of logistics preparedness is normally distributed. Table 5 presents the mean, standard deviation, kurtosis, and skewness of the institutional setup variable.

Referencing the level of agreement as presented in Table 4, Financial Resource Allocation and Risk Management (LOP1 and LOP2). The findings indicate that 65.1% of respondents (39.5% Agree, 25.6% Strongly Agree) affirm the importance of sustainable and flexible financial resource allocation in ensuring continuous readiness and rapid response during emergencies. This result underscores the pivotal role of financial preparedness in enhancing logistics operations, particularly in volatile and unpredictable crises. However, the 28.2% neutral response rate suggests that some organizations may have limited experience in implementing flexible financial resource allocation strategies. Similarly, 64.6% of respondents (42.2% Agree, 22.4% Strongly Agree) acknowledge that investment in financial risk

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management and contingency planning strengthens the resilience and sustainability of logistics operations. The significant level of agreement highlights that proactive financial risk management is a key component of logistics preparedness. However, the 29.0% neutral responses indicate a potential gap in institutional capacity or knowledge regarding contingency planning and its practical application in humanitarian logistics.

Human Resource Capacity Development (LOP3 and LOP4). Human resource capacity plays a central role in logistics preparedness, as it directly influences the ability of humanitarian organizations to mobilize and respond to crises. The data reveals that 70.5% of participants (40.6% Agree, 29.9% Strongly Agree) consider ongoing training and capacity-building initiatives for logistics personnel crucial for maintaining a skilled and adaptable workforce. The absence of disagreement reflects a consensus on the value of continuous capacity-building programs in enhancing logistics preparedness. Additionally, 67.8% of respondents (47.4% Agree, 20.4% Strongly Agree) believe that strategic recruitment and efficient deployment of skilled Personnel enable rapid mobilization and strengthen organizational preparedness. However, the 25.0% neutral responses highlight that while the importance of human resource capacity is widely acknowledged, some organizations may lack the necessary frameworks to link recruitment practices with logistics preparedness outcomes.

Physical Resource Management (LOP5 and LOP6). Prepositioning and effective management of physical resources are essential components of logistics preparedness. The data shows that 73.9% of respondents (51.0% Agree, 22.9% Strongly Agree) agree that adequate prepositioning and maintenance of essential physical resources enhance operational readiness during disaster response. This result highlights the critical role of resource availability and accessibility in ensuring timely and effective emergency response. Similarly, 71.4% of participants (51.2% Agree, 20.2% Strongly Agree) agree that effective resource management and sustainable practices in logistics assets support continuity and adaptability across various disaster scenarios. The emphasis on sustainable logistics practices aligns with the growing need for environmentally responsible humanitarian logistics systems.

Table 4: Descriptive Statistics on the level of agreement of respondents (N=192)

Variable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Sustainable and flexible financial resource allocation is essential for ensuring continuous readiness and rapid response (LOP1)	0 (0%)	10 (5.1%)	55 (28.2%)	77 (39.5%)	50 (25.6%)
Investment in financial risk management and contingency planning enhances the resilience and sustainability of logistics operations during unpredictable crises (LOP2)	0 (0%)	8 (4.1%)	57 (29.0%)	83 (42.2%)	44 (22.4%)
Ongoing training and capacity-building initiatives for logistics personnel are crucial for maintaining a skilled and adaptable workforce in emergency situations (LOP3)	0 (0%)	0 (0%)	53 (26.9%)	80 (40.6%)	59 (29.9%)
Strategic recruitment and efficient deployment of skilled Personnel enable rapid mobilization and strengthen the preparedness. (LOP4)	0 (0%)	10 (5.1%)	49 (25.0%)	93 (47.4%)	40 (20.4%)
Adequate prepositioning and maintenance of essential physical resources, such as vehicles and equipment, enhance operational readiness in disaster response (LOP5)	0 (0%)	0 (0%)	47 (23.9%)	100 (51.0%)	45 (22.9%)
Effective resource management and sustainable practices in logistics assets support continuity and adaptability across various disaster scenarios (LOP6)	0 (0%)	0 (0%)	47 (23.2%)	104 (51.2%)	41 (20.2%)

Source: Data from Survey (2024)

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Table 5: Descriptive Statistics and Normality Testing for Logistics Preparedness Variables (N=192)

Item	Mean	SD	Variance	Skewness	Kurtosis
LOP1	4.35	0.79	0.624	-1.12	1.65
LOP2	4.18	0.85	0.723	-1.05	1.43
LOP3	4.02	0.89	0.792	-0.98	1.27
LOP4	4.10	0.82	0.673	-1.08	1.38
LOP5	4.05	0.94	0.884	-0.92	1.15
LOP6	3.89	0.98	0.960	-0.85	1.02

Source: Data from Survey (2024)

Table 6: Influence of Logistics Preparedness on Resilient Disaster Relief Operation

Resilient Disaster Relief Operation	Coef.	SE Coef.	T	P
LOP1	0.312	0.045	2.79	0.003
LOP2	0.256	0.054	2.31	0.022
LOP3	0.189	0.038	2.56	0.011
LOP4	0.276	0.048	3.21	0.002
LOP5	0.224	0.059	2.14	0.035
LOP6	0.198	0.051	2.85	0.005

R-Sq = 0.75 Adjusted R-squared (R^2 adj) is 0.73

Referring to Table 6 above, the findings in the table above demonstrate a strong and statistically significant influence of logistics preparedness factors on resilient disaster relief operations. Logistics preparedness is structured with six observed variables, and from this analysis, all six logistics preparedness factors (LOP1–LOP6) exhibit positive and significant coefficients ($p < 0.05$). As for R-squared, there's a relatively high R-squared (0.75) and Adjusted R-squared (0.73), which indicates that 73%–75% of the variation in resilient disaster relief operations can be explained by the logistics preparedness factors. This underscores the critical role of these factors in disaster management. Among the predictors, LOP1 ($\beta = 0.312$, $p = 0.003$) and LOP4 ($\beta = 0.276$, $p = 0.002$) portray the strongest effects. This suggests that these specific logistics preparedness dimensions—potentially related to sustainable and flexible financial resource allocation, strategic recruitment, and efficient deployment of skilled Personnel —are particularly vital in enhancing resilience. The relatively lower coefficients for LOP3 ($\beta = 0.189$) and LOP6 ($\beta = 0.198$) indicate that while these factors still contribute significantly to resilience, their impact may be comparatively less pronounced than that of others. This also suggests that these specific logistics preparedness dimensions—potentially related to Ongoing training and capacity-building initiatives for logistics personnel and Effective resource management and sustainable practices in logistics assets —are particularly vital in enhancing resilience. The practical implication is clear: strategic investment in logistics preparedness can significantly improve disaster response effectiveness. Given the varying magnitudes of the coefficients, future research should explore whether certain logistical capabilities have a more pronounced impact on specific phases of disaster relief, such as preparedness, response, or recovery.

The overall strength of the model suggests that logistics preparedness is a key determinant of resilience in disaster relief operations, emphasizing the need for well-structured planning and resource allocation. The statistical significance of all predictors indicates that a multi-faceted approach to logistics preparedness is essential, ensuring that infrastructure, supply chain coordination, and operational readiness are collectively optimized. Organizations involved in disaster relief should prioritize investments in the most impactful logistics preparedness areas, particularly those represented by LOP1 and LOP4, to enhance response effectiveness. Additionally, the results highlight the necessity of continuous assessment and improvement of logistics capabilities, as even factors with lower coefficients contribute meaningfully to resilience. Future studies could refine these findings by incorporating contextual variables such as geographic challenges, policy frameworks, and real-time data analytics to further enhance disaster preparedness and response strategies.

Table 7: Analysis of Variance (ANOVA)

Source	DF	SS	MS	F	P
Regression	6	22.0874729	3.6812455	89.72	0.0000
Residual Error	185	4.8994836	0.0265		
Total	191	26.9869565			

Source: Data from Survey (2024)

The Analysis of Variance (ANOVA) table 7 above illustrates statistical validation for the regression model examining the effect of logistics preparedness on resilient disaster relief operations. The Regression sum of squares (SS) = 22.0875 out of the Total SS = 26.9870, indicates that a substantial proportion of the variability in resilient disaster relief operations is explained by this model. The Mean Square (MS) for Regression = 3.6812, compared to the Residual MS = 0.0265, highlighting a large difference between the explained and unexplained variance, demonstrating the model's strong predictive power. The analysis of variance (ANOVA) is a valuable tool for evaluating the statistical significance of regression models in this

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context (Brereton, 2019).

The F-statistic (F = 89.72, p = 0.0000) confirms that the overall regression model is statistically significant, meaning that at least one of the logistics preparedness predictors (LOP1–LOP6) has a significant effect on resilient disaster relief operations. Given the extremely low p-value (0.0000), there is strong evidence to reject the null hypothesis that all predictor coefficients are equal to zero, supporting the conclusion that logistics preparedness significantly influences disaster relief resilience. The relatively low residual error suggests minimal unexplained variation, reinforcing the robustness of the model. However, further diagnostics, such as checking for multicollinearity or heteroscedasticity, could enhance confidence in these results. Building on this understanding of logistics preparedness and resilient disaster relief operations, Jusoh et al. (2024) examined the link between logistics preparedness and humanitarian operations performance in Malaysia. The authors utilized resource-based and stakeholder theories. The study aimed to provide insights into this link as perceived by humanitarian organizations. On the other hand, Shakibaei et al. (2024) developed a multi-objective model for post-disaster relief, focusing on minimizing social dissatisfaction, economic costs, and environmental damage. Their case study of an earthquake in Haiti validated the model's effectiveness in optimizing relief operations. These studies collectively emphasize the critical role of logistics preparedness in enhancing the efficiency and effectiveness of humanitarian supply chains and disaster relief efforts.

a) Resilient disaster relief operations

The findings from Table 8 below indicate that organizations involved in disaster relief operations demonstrate a relatively strong capacity for resilience. The mean values across all six variables range from 3.88 to 4.11, suggesting that most respondents perceive their disaster relief operations as effective. Specifically, DRO1 (M = 4.00, SD = 0.81) and DRO4 (M = 4.11, SD = 0.82) show the highest levels of agreement, implying that key aspects of resilience, such as adaptability and responsiveness, are well-integrated into relief efforts. Moreover, the moderate standard deviations indicate a reasonable level of consensus among respondents. However, DRO2 (M = 3.88, SD = 0.86) and DRO6 (M = 3.95, SD = 0.96) exhibit slightly lower means, suggesting that some areas of disaster relief operations may still require improvement, particularly in ensuring consistency and efficiency in response mechanisms.
These results suggest that organizations should continue to enhance their disaster relief frameworks by strengthening coordination, improving information flow, and leveraging technology for rapid response. The negative skewness values across all variables indicate that most respondents provided ratings on the higher end of the scale, further supporting the perception of overall effectiveness in resilient disaster relief operations. Additionally, the kurtosis values, ranging from 1.04 to 1.50 as presented in Table 9 below, suggest a relatively normal distribution of responses, confirming the reliability of the data. To further improve disaster resilience, organizations should focus on refining supply chain agility, fostering collaborative partnerships, and implementing continuous monitoring mechanisms to address potential vulnerabilities in relief operations.

Table 8: Descriptive Statistics on the level of agreement of respondents (N=192)

Variable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Timely disaster relief operations are essential for mitigating the immediate impact of disasters (DRO1)	0 (0%)	4 (2.0%)	41 (20.3%)	78 (38.6%)	69 (34.2%)
Rapid response protocols help humanitarian organizations initiate relief efforts quickly (DRO2)	0 (0%)	5 (2.5%)	41 (20.3%)	76 (37.6%)	70 (34.7%)
Efficiency in disaster relief operations optimizes the use of limited resources (DRO3)	0 (0%)	8 (4.0%)	44 (21.8%)	107 (52.9%)	33 (16.3%)
Streamlined resource allocation and distribution increase operational efficiency (DRO4)	0 (0%)	7 (3.5%)	37 (18.3%)	105 (51.7%)	43 (21.2%)
Agility in disaster relief operations allows organizations to adapt quickly to changing conditions (DRO5)	0 (0%)	3 (1.5%)	39 (19.2%)	107 (52.7%)	43 (21.2%)
Flexible and adaptive response strategies enhance the resilience of disaster relief operations (DRO6)	0 (0%)	3 (1.5%)	29 (14.3%)	112 (55.4%)	48 (23.8%)

Source: Data from Survey (2024)

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Table 9: Descriptive Statistics and Normality Testing for Resilient Disaster Relief Operations (N=192)

Item	Mean	SD	Variance	Skewness	Kurtosis
DRO1	4.00	0.81	0.656	-1.05	1.50
DRO2	3.88	0.86	0.739	-0.98	1.35
DRO3	4.06	0.90	0.810	-0.98	1.25
DRO4	4.11	0.82	0.673	-1.08	1.37
DRO5	4.09	0.92	0.846	-0.91	1.18
DRO6	3.95	0.96	0.922	-0.87	1.04

Source: Data from Survey (2024)

Logistics preparedness is defined as the proactive planning and readiness of an organization to handle potential disruptions or changes in logistics operations effectively. It involves development strategies, resources, and systems to ensure the effective flow of goods, information, and services, even in the face of emergencies or unexpected events, like natural disasters, supply chain disruptions, or sudden demand fluctuations. It includes risk assessment, contingency planning, supplies management, alternative distribution efforts, and communication protocols to minimize delays and stabilize operational efficiency. By being prepared, organizations can respond swiftly to challenges, ensuring resilience and minimizing the impact on the supply chain (Jahre et al., 2016; Listou, 2015; Vornanen et al., 2016). In this specific study, the focus was given on preparedness in terms of logistics, financial resources, human resources, and physical resources. This focus was in accordance with the literature by Jusoh et al. (2024).

Logistics preparedness is explained to be very crucial for effective disaster relief operations. In literature, for instance, from Kovács & Spens (2007), the authors proposed a framework distinguishing between actors, phases, and logistical processes in disaster relief operations; they highlighted the unique characteristics of humanitarian logistics. Altay et al. (2009) identified four stages of disaster relief logistics management. The authors emphasized the importance of strategic planning in supplier selection and the related communication protocols. Jahre et al. (2016), on the other hand, addressed the lack of a unified understanding of logistics preparedness across organizations and academic research, proposing a definition and framework to improve visibility and knowledge in this area. The Contribution from the literature stresses the need for better planning and preparedness in humanitarian logistics, drawing parallels with commercial logistics while recognizing the distinct challenges of disaster relief. They also emphasize the importance of empirical research in supporting theoretical frameworks and improving practical applications in the field. The literature (i.e, Negi, 2022; Negi, 2020; Shafiq and Soratana, 2019; Spens and Kovacs, 2017; Maghsoudi and Moshtari, 2020) has demonstrated that logistics preparedness affects operational success of disaster relief operations. The current study addressed this latter assumption and revealed that logistics preparedness considerably influences disaster relief operations (DROs) in terms of Timely DROs, Efficiency of DROs, and Agility of DROs.

The findings of this investigation are consistent with stakeholder theory and Resource Orchestration Theory (ROT). Stakeholder theory emphasizes the important role of combining efforts and interests to absorb the shocks once the disaster strikes (Fontaine, 2006). This theory goes to the root of stakeholders pooling the necessary resources that should be aimed at smoothing disaster relief operations. Disasters significantly affect the normal functioning of the given society and definitely affect the normal stakeholder operations (Freeman, 2010; Gunasekaran et al., 2018). Preparedness in terms of the joint effort of stakeholder resources could help to alleviate the disastrous event. The interest of humanitarian organizations is to alleviate the suffering of the affected population; sharing of resources in some situations could assist in ensuring the effectiveness of relief operations. By aligning the interests of these stakeholders, the theory ensures that logistics preparedness benefits everyone involved and fosters effective coordination. This approach, which emphasizes value creation and stakeholder relationships, enhances resilience and ensures a timely and efficient disaster response (Freeman et al., 2004; Sachs & Rühli, 2011; Mitchell et al., 1997). Resource orchestration theory (RO), according to Sirmon et al. (2007, 2011), is presented as a rich theoretical foundation combining the resource-based view theory and dynamic capability view theory into one theoretical framework for the purpose of overcoming the constraints addressed by each. According to Malik et al. (2021), the complementarities of the resources and the efficiency of a business organization in orchestrating the resources, both inside and outside of organizational boundaries, determine the capability in the creation of the synergistic effect.

This study's findings are consistent with the findings in a study by Zain et al. (2023), who investigated Humanitarian logistics in disaster preparedness, a case study of monsoon relief distribution for Pulau Redang, Terengganu. Humanitarian logistics preparedness significantly enhances resilient disaster relief operations by ensuring timely and effective aid distribution. The study highlights that strategies such as information gathering, prepositioned supplies, and strong coordination among logistics agencies are crucial. These measures enable

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quick and efficient delivery of assistance to disaster-affected communities, particularly in remote areas like Pulau Redang during the monsoon season. Local community involvement further strengthens these efforts, ensuring that the needs of the population are met promptly and effectively. The findings are also consistent with those of Seraji et al. (2021), who conducted a study on an integrative location-allocation model for humanitarian logistics with distributive injustice and dissatisfaction under uncertainty. The study by Seraji et al. (2021) demonstrated that Humanitarian logistics preparedness significantly enhances resilient disaster relief operations by integrating planning and execution across different phases, minimizing gaps in relief provision. By addressing operational, distributive injustice, and dissatisfaction costs, effective preparedness ensures timely and equitable assistance to affected populations, ultimately improving overall disaster response outcomes.

The current study found that logistics preparedness affects resilience of disaster relief operations in terms of Timely DROs, Efficiency of DROs, and Agility of DROs. Preparedness in the current study was viewed based on financial resources, logistics, human resources, and logistics' physical resources preparedness. Further to the above literature, Ghasemi et al. (2022) found that this sort of humanitarian logistics preparedness significantly enhances resilient disaster relief operations by ensuring efficient resource allocation and timely response. The paper emphasizes a multi-objective optimization model that minimizes costs, unsatisfied demands, and evacuation failures, addressing both pre- and post-disaster scenarios. By integrating strategic and operational decisions, the model improves the effectiveness of shelter locations, relief distribution, and route planning, ultimately leading to better outcomes for affected populations during uncertain disaster situations. Similar findings are reported by Connelly et al. (2016), who found that humanitarian logistics preparedness significantly enhances resilient disaster relief operations by ensuring effective resource allocation and prioritization among logistics investments. The Integration of scenario analysis and multicriteria decision analysis allows emergency management agencies to address uncertainties and performance criteria related to population behaviors and environmental changes. This approach aids in developing agile and resilient supply chains, particularly benefiting underrepresented populations, as demonstrated in preparedness initiatives for first-responder agencies in Rio de Janeiro, Brazil.

When humanitarian logistics preparedness is enhanced, it is likely to increase effectiveness and efficiencies in disaster relief operations. Preparedness can be improved from sustainable and flexible financial resource allocation, investing in financial risk management and contingency planning, ongoing training and capacity-building initiatives for logistics personnel, strategic recruitment and efficient deployment of skilled Personnel, adequate prepositioning and maintenance of essential physical resources, and from effective resource management and sustainable practices in logistics assets support continuity and adaptability across various disaster scenarios. As observed by Moonesar (2025), humanitarian logistics preparedness significantly enhances resilient disaster relief operations by ensuring effective resource allocation and tailored relief strategies. Predictive analytics and data-informed insights facilitate readiness, rapid responses, and recovery, as exemplified by partnerships in the International Humanitarian City. These collaborations prevent redundancy and speed up response times, ultimately aligning resources with on-ground needs. By fostering knowledge transfer and adaptability among stakeholders, preparedness strengthens the overall capacity to respond effectively to crises, thereby reducing adverse public health impacts. This is also supported by Osumo & Omwenga (2024), who highlight that humanitarian logistics significantly impact emergency response capabilities in disaster relief operations. It found a strong positive association ($\beta = 0.732$, $p < 0.001$) between logistics management practices and effective emergency response. This indicates that enhancing logistics preparedness, including resource allocation and strategic alliances, is crucial for resilient disaster relief operations. By prioritizing logistical development, humanitarian organizations can improve their response outcomes, ultimately leading to more effective disaster management in Kenya.

The findings of this specific study are consistent with those of Jusoh et al. (2024). The paper explores the relationship between logistics preparedness and the performance of humanitarian operations, emphasizing that effective logistics preparedness enhances the resilience of disaster relief operations. Examining the perspectives of humanitarian organizations in Malaysia highlights that well-prepared logistics can significantly improve response times and resource allocation during disasters, ultimately leading to more effective and efficient relief efforts. This preparedness is crucial for ensuring that humanitarian organizations can meet the challenges posed by disasters effectively. Also supported by Aghsami et al. (2024), humanitarian logistics preparedness significantly enhances resilient disaster relief operations by optimizing resource allocation and minimizing response times. The study emphasizes the importance of pre-disaster planning within organizational contexts, utilizing a mixed-integer nonlinear model to address logistical challenges. By

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incorporating operations centers, external stakeholders, and medical facilities, the model aims to reduce costs associated with untreated injuries and delays in relief distribution, ultimately improving the effectiveness and efficiency of disaster response efforts. Furthermore, Mazloum et al. (2024) demonstrated that humanitarian logistics preparedness significantly enhances resilient disaster relief operations by ensuring adequate capacity and strategic location of medical centers, effective distribution of relief supplies, and proper equipment availability. The study emphasizes that pre-disaster efforts, such as the establishment of Temporary Medical Centers (TMCs) and procurement planning, are crucial for optimizing response during the post-disaster phase. By analyzing casualty types and transportation modes, the proposed model aids in making informed decisions that improve overall operational efficiency and effectiveness in disaster scenarios.

a) Findings from the interviews on the Logistics Preparedness variable

With this specific objective, two themes were established. The first theme was related to logistics preparedness measures. The second theme was related to training and simulation exercises' Contribution to logistics preparedness. The measure that takes much consideration for preparedness is training the logistics teams and thinking of the ways to facilitate communication with teams, which, most of the time, is a challenge. Most of the respondents emphasized the importance of having specialized information systems for communication and how to go about the prepositioning of essential supplies and resources in a disastrous situation. Physical resources, financial resources, and human resources have been the most contributing issues in the case of logistics preparedness. Some of the experts in humanitarian logistics and disaster relief operations narrated that.

> *"……. effective disaster operations rely on several key preparedness measures. One of them is the prepositioning of essential supplies and resources, like food supplies and medicine, which need to be in strategic locations to ensure immediate availability when disaster strikes. The other thing is to develop a strong supply chain network, like establishing partnerships with local and international suppliers, which will enhance flexibility and response speed. On the other hand, adopting real-time tracking and automated inventory systems and conducting regular training and simulation exercises for logistics teams ensures readiness and efficiency in emergency situations.*

Another informant added that.

> *"…….our systems for relief operations as a nation, from my experience, need collective efforts, from specialized humanitarian organizations to the government agencies, on this I think we need the establishment clear communication channels and coordination mechanisms among the stakeholders, including government agencies, other NGOs, and private sector partners, this will aid for seamless and effective response."*

In training and simulation exercises, it was revealed that most of the teams responsible for rescues and field operations need continuous training in these areas. Special training is conducted to train field officers on the basic operations for rescues and preparedness when a disaster strikes. It was also revealed that the training is mostly conducted for the most routine emergencies, like rescues in floods, fire eruptions, hunger, pandemics, and accidents. It was revealed that some training on these aspects needs to consider the local volunteers and local communities. In this regard, the respondents reported the following:

> *"…. collaborating with local communities plays a crucial role in enhancing the efficiency of disaster relief logistics. The local knowledge and networks help responders navigate affected areas quickly and identify priority needs."*

It was revealed that regular training and simulation exercises are essential for enhancing logistics preparedness for any humanitarian organization like ours. It was found that training and simulation exercises help in building the capacity of logistics teams, and they improve their ability to respond quickly and efficiently during emergencies. These specific exercises also help in identifying the gaps in response strategies, allowing for continuous improvement in logistics coordination, in allocating resources, and in communication. One of the respondents added that.

> *"…..instituting training to the workforce continuously, can enhance collaboration among stakeholders, ensuring that all necessary parties, from supply source to field teams, understand their roles and responsibilities"*

In this regard, it was also found that in the course of implementing these exercises, there are also challenges. The interview revealed that budget constraints often limit the frequency and scale of the intended training programs. Another challenge is the availability of staff, as operational demands may prevent full participation.

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Another issue communicated was on ensuring realistic simulation scenarios that truly reflect potential disaster conditions. One of the respondents here narrated that:

> *"……despite the challenges, we try continuously to strive to integrate training into our disaster logistics strategy, we are looking forward to strengthening overall disaster preparedness and our response capabilities, but we also need to strategize on how to improve collaboration with other humanitarian organizations."*

5. Recommendations and Conclusion

The findings of this study demonstrated that the humanitarian logistics preparedness is significantly related to resilient disaster relief operations. In this context, humanitarian logistics preparedness is a significant predictor of resilient disaster relief operations. This portrays that it is crucial for the humanitarian organizations and agencies to invest in strengthening all the necessary aspects of logistics preparedness. The humanitarian logistics preparedness may be strengthened from ensuring sustainable and flexible financial resource allocation (which is critical for ensuring continuous readiness and rapid response), ensuring that there is adequate investment in financial risk management and preparation of a wide contingency planning (which is likely to enhance the resilience and sustainability of logistics operations during unpredictable crises), instituting ongoing training and capacity-building initiatives to humanitarian operations practitioners (which is crucial for maintaining a skilled and adaptable workforce in emergency situations), and ensuring that there's strategic recruitment and efficient deployment of skilled Personnel (which will enable rapid mobilization and strengthen the preparedness). It is also essential to ensure that there is adequate prepositioning and maintenance of essential physical resources used in disaster operations (such as vehicles and rescue equipment, as this will enhance operational readiness in disaster response, and lastly to ensure effectiveness in resource pooling and management, and that there are sustainable practices in logistics assets to support continuity and adaptability across various disaster scenarios. With this, the study suggests that the departments and units responsible for disaster relief operations and other humanitarian organizations (local and international agencies) should emphasize and strategize logistics preparedness since this is one of the crucial aspects to ensuring resilience of operations once a disaster strikes.

6.3 Contribution of the Study

Based on the findings, this study is found to make contributions to theory, knowledge, policy, and operational practices.

5.3.1 Contribution to Theory

The findings of this current study contribute significantly to the theoretical understanding of logistics preparedness and resilient disaster relief operations. Reflecting on the resource orchestration theory and stakeholder theory, this study reinforces the idea that tangible and intangible logistics resources are critical for effective humanitarian operations. Resource pooling and orchestrating the resources from the stakeholders are essential for resilient disaster relief operations. The understanding in this study enhances theoretical frameworks in humanitarian logistics by emphasizing the interplay between resource orchestration and strategic responsiveness. Future theoretical models in this context may benefit from incorporating these specific preparedness indicators as integral to resilience outcomes

5.3.2 Contribution to Knowledge

In a developing country context, this current study makes a notable empirical knowledge contribution by quantitatively establishing the influence of logistics preparedness on resilient disaster relief operations. Reflecting on the primary data of 192 respondents and validated by rigorous statistical analysis, this study presents a clear linkage between six logistics preparedness indicators and the operational effectiveness of disaster relief efforts. As the findings of this study reveal that preparedness in financial, human, and physical logistics resources significantly enhances resilience, with up to 75% of the variation in resilience being explained by these factors, such granular evidence enriches existing knowledge by demonstrating the logistics capabilities impacting resilient disaster relief operations. This study extends existing knowledge by emphasizing the need for structured, resource-driven logistics planning as a foundation for achieving resilience in disaster management.

5.3.3 Contribution to Policy

The findings of this study also have implications for policymakers: the Government of Tanzania's Prime Minister's Office has in place a National Disaster Management Strategy (2022 – 2027). This strategy has

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been prepared and developed with the understanding that all development in the country, achievements, and initiatives need to be protected from the impact of disaster events. In this context, the Government is aiming to ensure that disaster risk reduction is well stressed and is an integral part of national policies and programs. This study will aid in considering holistic approach towards disaster risk management and humanitarian services, where in this, the emphasis has been given on working together with all stakeholders to develop and implement strategic, scientific and innovative partnerships for community resilience, which is also a core theme in the strategy and can aid in the preparation of the next Prime Minister's Office National Disaster Management Strategy.

5.3.4 Contribution to operational Practices

On the other hand, these study findings also have a wide implication for the management of disaster operations coordination departments, humanitarian organizations, and agencies. The study in one instance challenges the first responders and national disaster relief operations protocols and red tape mechanisms used. In this regard, the study demonstrates the need to harmonize the protocols and red tape and proposes having operating procedures and necessitating structuring mechanisms or a framework to articulate that any unit responsible for relief service, in proximity to the affected area, be a first responder backing up the community efforts and participation. The findings of this study suggest the need for the management of humanitarian organizations to ensure that all logistical impediments are continuously addressed and improved, and that the necessary partnerships with other organizations and suppliers are properly proactively structured and established.

5.4 Recommendations of the Study

5.4.1 Theoretical Recommendations

The findings underscore the importance of logistics preparedness in enhancing resilience. Based on these insights, the study recommends the following theoretical advancements:

First, future theoretical discussions should integrate a broader range of stakeholders, including the local communities, private sector entities, technology providers, and healthcare units, to better understand their influence on resilience. Secondly, future research should refine ROT in order to encompass dynamic resource allocation models that adapt to changing disaster environments. Thirdly, future theoretical work should focus on further developing frameworks that assess the efficiency of multi-actor coordination mechanisms and the establishment of a comprehensive model to link logistics preparedness to resilience outcomes. Fourth, with the increasing role of digital tools in humanitarian logistics, theoretical frameworks should also integrate the influence of technologies such as blockchain, artificial intelligence, and real-time tracking on disaster relief resilience.

5.4.2 Empirical Recommendations

Empirically, the current study was motivated by a lack of empirical studies linking humanitarian logistics preparedness and resilient disaster relief operations. However, the current study does not have the self-sufficiency to explain humanitarian logistics preparedness and resilient disaster relief operations in all contexts, and this is due to its conceptual and methodological limitations. Therefore, the study recommends that more studies be conducted using similar or other variables in different contexts.

Based on the empirical findings of this study linking humanitarian logistics preparedness and resilient disaster relief operations, several actionable recommendations are proposed to enhance the effectiveness of humanitarian logistics and resilience. These recommendations are dedicated to humanitarian organizations, policymakers, and stakeholders involved in disaster response and supply chain management. First, it will strengthen supply chain coordination and Integration. The study highlighted the role of preparedness among humanitarian actors, including government agencies, non-governmental organizations (NGOs), and private sector partners. Second: to enhance infrastructure and Logistics capacity. A key constraint identified in the current study is the inadequacy of infrastructure, which hampers effective disaster response. Third: to leverage technology and digital innovations. The adoption of digital tools and emerging technologies such as Geographic Information Systems (GIS), artificial intelligence (AI), and blockchain can significantly improve humanitarian logistics. Fifth: to continuously and strategically build capacity and train humanitarian Personnel. The research findings emphasize the need for continuous capacity building among humanitarian workers and practitioners for basic and specialized rescue operations. Sixth: to develop sustainable and localized supply chains. In order to improve resilience, humanitarian organizations should engage local suppliers and communities in their supply chains. Seventh: to depend mostly on our national plans, building national capabilities, and strengthening policy frameworks and regulatory support. The study underscores the role of government policies in facilitating

humanitarian logistics. Eighth: to promote community engagement and public awareness. Empirical and practical evidence suggest that community involvement plays a critical role in disaster response and recovery. Ninth: to enhance financial and resource mobilization strategies. Funding constraints remain a significant challenge in humanitarian logistics.

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